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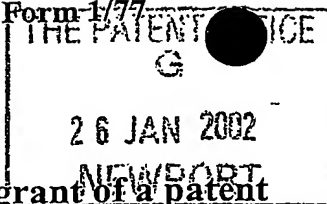
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2. Patent application number (The Patent Office will fill in this part)	0201867.9		26 JAN 2002
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Patents ADP number (if you know it)			
If the applicant is a corporate body, give the country/state of its incorporation	England and Wales 7221203001		
4. Title of the invention	A Lock		
5. Name of your agent (if you have one)	Saunders & Dolleymore		
"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)	9 Rickmansworth Road Watford Hertfordshire WD18 0JU		
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Priority documents

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Statement of inventorship and right to grant of a patent (*Patents Form 7/77*) 1

Request for preliminary examination and search (*Patents Form 9/77*) 1

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11. I/We request the grant of a patent on the basis of this application.

Saunders & Dolleymore

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Saunders & Dolleymore

Date

25 January 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

Stuart Fitchett
01923 238311

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A LOCK

The present invention relates to a lock and in particular, but not exclusively, to a lock suitable for remote applications, applications where a number of authorised individuals need to be able to open the lock and where it may subsequently be necessary to authorisation from selected individuals without the requirement to obtain return of a key associated with the lock.

The present inventors have identified that there is a need for a lock that is robust, can be operated by a number of individuals and which is intelligent. "Intelligent" in the sense used herein means that the lock should be able to communicate information relating to an associated key, thus possibly identifying the key operating the lock, and/or identifying different keys and controlling access in dependence on the key used and logic programmed in the lock. The term "key" encompasses any device which has to be presented to the lock to operate it, particularly the term encompasses electronic programmable cards, sometimes referred to as "smart cards", and tokens, the latter possibly being in the form of a key fob for a key ring. Such keys can communicate by a contact less coupling for example infrared Radio waves or by inductive coupling.

According to the present invention there is provided a lock comprising: an electronic module; a secure housing having a first portion containing mechanical components of the lock; a second portion for receiving the electronics module; and a handle mounted externally of the secure housing, the electronics module comprising: a power supply; a contact less receiver capable of receiving an authorisation signal from a contact less key when in close proximity to the receiver; and an actuator responsive to said authorisation signal, the mechanical components in the first portion of the housing comprising: a retaining pin for releasably retaining a bolt in position in the lock and a linkage mechanism for connecting the handle to the retaining pin to cause movement of the handle to displace the retaining pin, wherein the actuator of the electronic module interacts with the linkage mechanism such as to permit movement of the handle to displace the retaining pin when an authorisation signal has been received.

A lock according to the invention is particularly advantage in a remote or hostile environment. Taking for example a site for a mobile radio mast, such a site will typically comprise a perimeter fence enclosing apparatus belonging to several companies. In such an application operatives of the respective companies will need access to the site. In addition,
5 it may also be necessary to occasionally provide access to contractors charged with the performance of specific tasks within the site. Employing the present invention enables a common lock to be provided with any number of keys issued, each key in the form of a contact less card or tag issued to appropriate personnel. Each key, or group of keys, can have a unique code and the lock can be arranged, by programming of the electronic module,
10 to selectively permit operation of the lock depending on information received in the signal from the key.

The function and advantages of electronic or intelligent locks, are already known, most of which would be applicable to a lock in accordance with the present invention.
15 These are too numerous to list here, but by way of illustration the lock may for example be programmed, either by transmitting a signal to it on site or by programming the electronic module off site, such that it may recognise only certain cards issued as being authorised, such as cards belonging to one company, or may permit access only at certain times.

A particular advantage of having a electronic module which can be removed from the lock is that if a module needs to be reprogrammed or replaced for some other reason, for example the power supply contained within that module is failing, (which power supply will normally be in the form of battery contained within the module), then the module may be arranged so that the module can simply be replaced without removing or dismantling the
20 lock.
25

A problem with an electronic lock for a remote application is that, taking the example of a perimeter fence, the lock may be remote from a power supply and may be visited infrequently, thus the useful lifetime of the module will often depend on the
30 requirement for electronic power from a power supply contained within the module. The present invention greatly reduces the drain on the power supply of the electronic module by having a mechanism whereby it is the action of the handle that physically withdraws the retaining pin, the electronics module only enabling the release of the retaining pin.

Preferably the lock further comprises a mechanical key operated lock for releasing the electronic module. This enables the electronic module to be replaced, even after it has failed, but the mechanical key operated lock ensures restricts access to this function.

5

It is particularly advantageous if the mechanical key operated lock can also release the locking pin from the bolt to perform a manual override operation in the event of failure of the electronic module. This is particularly advantageous because the same key operated lock can perform two functions that may both be required in the event of a failure of the electronics module.

10

The lock may be arranged such that turning the key in the mechanical key operated lock in one direction releases the retaining pin from the bolt, whilst turning the key in the opposite direction releases the electronic module from the housing. It is then preferable that the key operated lock is arranged to receive a first key type, which can only turn in one direction and a second key type can turn in the other direction or both, for it is then possible to have a first mechanical key type which can override the lock in the event of a failure of the electronic module and another key type which can both permit override and release of the electronics module.

20

It is particularly advantageous is the linkage mechanism only provides mechanical linkage between the handle and the retaining pin when an authorisation signal has been received. This avoids the possibility of extreme force being applied to the handle that could otherwise damage the locking mechanism, the handle being able to "freewheel" at other times. It further provides the possibility that where the electronic module is normally in a power conserving sleep mode with it's receiver turned off it can be awoken by mechanical operation of the handle, this operation of the handle will first awake the electronic module and then if an authorised electronic key is in close proximity to the receiver of the module then the actuator of the module may then permit force applied to the handle to be transmitted to the retaining pin to withdraw that retaining pin.

30

In addition to an authorisation being necessary to permit opening of the lock, it may also be advantageous if the electronics module and mechanical components are arranged

such that an authorisation signal has to be received to permit the bolt to locked into the lock by the retaining pin, especially if the electronics module comprises a sensor for detecting the presence of the bolt. These features enable the electronic module to store an audit trail identifying the key that authorised operation of the lock and thus permits the lock to both
5 record when the lock was opened and when it was subsequently closed.

Advantageously, the lock may comprise a dummy electronics module mechanically configured such that, when inserted into the second portion of the secure housing, the dummy module physically interacts with the mechanical components to mechanically
10 release the lock, this permitting the lock to be placed in a manual override position when the electronics module is removed.

According to the second aspect of the invention there is provided a contact less key tag for use with the lock as claimed in any preceding claim.

15 One embodiment of the present invention will now be described, by way of example only, with reference to the accompanying figures, in which like numerals are used throughout to indicate like parts and of which:

Figure 1 is a perspective view of a lock in accordance with the present invention;

20 Figure 2 is a schematic partially sectioned side elevation of the lock of Figure 1 in a closed position;

Figure 3 shows the same view as Figure 2 but with the lock in an open position;

Figure 4 shows a section along the line 4-4 of Figure 2; and

25 Figure 5 is a perspective view of the electronics module of the lock of Figures 1, 2 and 3; and

Figure 6 is a perspective view of an alternative lock in accordance with the present invention

Referring to Figure 1 the lock, shown generally as 1, comprises a housing 2, an aperture 3 for receiving a bolt 19 (see figure 2), a handle 4 for actuating the lock, an aperture 5 for receiving an electronic module 6, electronic module 6 having a receiver 7 for communicating with a smart card 8 having a transmitter and associated circuitry 9 embedded therein.

The lock is preferably constructed of stainless steel and comprises an additional stainless steel cover plate 9 secured into place by a plurality of security screws 10. The screws may be any suitable commercial off-the-shelf screws having a specific head that requires a special tool to release them. Cover plate 9 obscures the position of a mechanical cylinder lock 11, the function of which is described below, and therefore hides a potential 'soft spot' of the lock 1.

Referring to the side elevation of Figure 2, this shows a partially cut-away section of the lock 1. The housing comprises a first portion 2A having mechanical components housed therein and a second portion 2B in which the electronics module 6 is located.

The electronics module 6, shown in more detail in Figure 5, additionally comprises a battery pack 12, an actuator 13 and a control circuit 14. The module 6 is retained within the housing against resilient block 15 by latch 16 engaging recess 32.

The mechanical components of the lock in housing 2A comprise a retaining pin 17 biased by spring 18 to the position shown in Figure 2 where it retains bolt 19 within the lock. The bolt 19 illustrated has a hole 20 therein to which a chain may be attached, but this is for illustrative purposes only and the bolt could equally be any bolt to be captivated within the lock. The principal other components are comprised in a linkage mechanism illustrated generally as 21, which is described below with reference to Figure 4. There are also two latching slides 22 and 23 the function of which is also described below.

Referring to Figure 4, a view along line 4-4 of Figure 2, this shows the linkage mechanism 21. This mechanism is supported by shaft 24 extending between the two handles 4 located to either side of the housing 2. The linkage mechanism 21 comprises a paddle wheel 25 and dog clutch 26 engaged by pawl 27. Paddle wheel 25 and dog clutch

26 are physically connected to handle 4 such that those components form a first unit. The linkage mechanism additionally comprises a driven shaft 28 to which the pawl 27 is attached, the driven shaft has an engagement surface 29 for contacting pin 30 extending from retaining pin 17, as shown in figures 2 and 3.

5

To the left-hand side of the apparatus of Figure 4 is located the electronic module 6. Referring to Figure 5, electronic module 6 has a recess 32 in the casing by which recess it is retained in position via latch 16. The electronic module 6 houses an actuator 13 that rotates a gear 33. This gear 33 is mounted on shaft 34 of the actuator 13 and acts on opposing racks 41 and 42 in the direction of arrows 40. The rack 41 interacts with a slide 22, whilst rack 42 has a protrusion 39 which interacts with pawl 27 via spring 35 pivoted on pin 36, as shown in figures 2 and 3.

10

The electronic module additionally comprises two sensors 43 and 44. The first sensor 43 is a reed switch and detects the presence of magnet 45 located at the end of bolt 19 when the bolt 19 is fully inserted within the lock. Sensor 44 is a sensor that detects movement of the paddle wheel by detecting the movement of magnets 25A to 25D retained in the wheel as they pass window 52 in the housing.

15

Describing now the operation of the lock, the lock 1 of Figure 1 is installed on a gate/door, or the like that it is desired be secured, in a position such that bolt 19 can be received in aperture 3. Authorised personnel on approaching the lock rotate handle 4 and simultaneously present a key in the form of an electronic card 8 or tag to the lock so that it is in close proximity to the receiver 7 of the electronic module 6.

20

25

As can be seen from Figure 4, rotation of handle 4 will cause paddle wheel 25 to rotate and magnets 25A to 25D to pass by sensor 44, which detects the movement and sends a signal to circuitry 14 (figure 2) to "wake up" the receiver 7. At this stage the handle 4 is free to rotate there being no connection between the driven plate 28 and the handle.

30

In response to the receiver receiving an authorisation signal from key 8, the control circuit 14 controls actuator 13 to drive the rack 42 of Figure 5. Protrusion 39 of rack 42 acts

on the spring 35, as shown in Figure 2, that in turn causes pawl 27 to engage the dog clutch 26, as most clearly seen from Figure 4. When the pawl 27 engages dog clutch 26 further rotation of the handle 4 causes the retention pin 17 to be withdrawn from the bolt 19, until in the position shown in Figure 3.

5

Referring to Figure 3, when the retention pin 17 is withdrawn, bolt 19 can be withdrawn. The retention pin is then latched in position by slides 22 and 23 being urged into the positions shown by the action of spring 48.

10

When the lock is in the open position, (Figure 3), and it is desired to engage the bolt 19 in the lock, the operative "wakes up" the receiver of the electronic module 6 by the mechanical operation of the handle 4 presenting magnets 25A to 25D to sensor 44. If receiver 7 detects the presence of an authorised key it then sends a signal causing actuator 13 to move rack 41 in the direction of arrow A of Figure 2. When the bolt is inserted into aperture 3, the movement displaces slides 23, and subsequently 22, permitting retaining pin 17 to engage the bolt 19. Note that if an authorisation signal is not been received, then the rack 41 will still be in the position indicated by arrow B in Figure 3. Slide 22 will thus be prevented from moving in a direction to the left of Figure 2 or 3 and thus retaining pin 17 will not engage bolt 19.

15
20

The circuitry 14 of the electronic module logs both the opening and closing of the lock identifying both the time and the identity of the card that caused the lock to be opened or closed, and could also log mechanical functions.

25

If the electronic module 6 should fail, or it is desired to replace the electronic module, the security plate 9 is removed and the key inserted into mechanical lock 11. Rotation of the key in a first direction causes locking bar 50 to engage latch 16 releasing it from the recess 32 in the electronic module 6. Rotation of the key anticlockwise, as best seen from Figure 2, causes the locking bar 50 to act against pin 51 withdrawing the retaining pin 17 from the bolt 19 and thereby releasing the bolt 19.

30

If it is desired to remove the electronic module 6, a dummy replacement module, containing no electronics, may be placed in the lock. A dummy module with an appropriate

protrusion to engage with pawl 27 but not slide 22 will allow the lock to operate manually without the need to operate the manual cylinder lock 11. A dummy module without the protrusion and that also does not engage slide 22 will place the lock into a key operated mode.

5

The lock so far described has been of the type that retains a bolt 19 in an aperture 3. However the invention is equally applicable to the lock in accordance with the invention shown in figure 6, where the lock has an integral bolt 52. This can be identical in all respects to the bolt 19 of the earlier figures, with the exception that it has a operating pin 53
10 extending there through.

15

Pin 53 extends through slots 54 in the housing 2 of the lock, enabling an operative to manually throw the bolt from a retracted position, within the lock, to an extended position, where it may engage a recess in the same manner as a mortise lock, and vice versa. The operation of the lock is identical to that previously described, (that is to say authorisation is required to throw the lock in either direction), with the exception that the bolt can not be completely removed from the lock.

20

Although two embodiment of the present invention have been illustrated with reference to the accompanying figures, it will be realised that many modifications or alternative arrangements of the lock will be apparent to one skilled in the art, which alternative arrangements will be within the scope of the claims.

CLAIMS

1. A lock comprising: an electronics module; a secure housing having a first portion containing mechanical components of the lock; a second portion for receiving the
5 electronics module; and a handle mounted externally of the secure housing, the electronics module comprising: a power supply; a contact less receiver capable of receiving an authorisation signal from a contact less key when in close proximity to the receiver; and an actuator responsive to said authorisation signal,

the mechanical components in the first portion of the housing comprising: a
10 retaining pin for releasably retaining a bolt in position in the lock and a linkage mechanism for connecting the handle to the retaining pin to cause movement of the handle to displace the retaining pin, wherein the actuator of the electronic module interacts with the linkage mechanism such as to permit movement of the handle to displace the retaining pin when an authorisation signal has been received.

15 2. A lock as claimed in Claim 1, comprising a mechanical key operated lock for releasing the electronics module.

3. A lock as claimed in Claim 2, wherein the key operated lock can also release the
20 locking pin from the bolt to perform a manual override operation in the event of failure of the electronics module.

4. A lock as claimed in Claim 2, wherein the turning of a key in the key operated lock in a first direction releases the retaining pin from the bolt and in a second direction releases
25 the electronic module from the housing.

5. A lock as claimed in Claim 4, wherein the key operated lock is arranged to receive a key type which can only turn the mechanical lock in one direction and a second key type that can turn the mechanical lock in the other direction or which can turn the mechanical
30 lock in both directions.

6. A lock as claimed in any preceding claim, wherein the linkage mechanism only provides a mechanical linkage between the handle and the retaining pin when an authorisation signal has been received.
- 5 7. A lock as claimed in any one of Claims 2 to 6, further comprising a security cover plate fixed over a keyhole for the mechanical lock.
8. A lock as claimed in any preceding claim, wherein the electronic module is normally in a sleep mode and is awoken by mechanical operation of the handle, such that
10 the receiver can then detect the presence of contact less key.
9. A lock as claimed in any preceding claim, wherein the electronics module and mechanical components are arranged such that an authorisation signal has to be received to permit the bolt to be locked into the lock by the retaining pin.
15
10. A lock as claimed in any preceding claim, wherein the electronics module comprises a sensor for detecting the presence of the bolt.
11. A lock as claimed in any preceding claim, wherein the electronic module stores an
20 audit trail identifying the contact less key that authorised operation of the lock.
12. A lock as claimed in any preceding claim, comprising a mock electronics module mechanically configured such that when inserted in the second portion of the secure housing it physically interacts with the mechanical components to manually release the
25 lock.
13. A lock substantially as hereinbefore described, with reference to, and/or as illustrated in one or more of the accompanying figures.
- 30 14. A contact less key for use with a lock, as claimed in any preceding claim.
15. An electronics module for use with a lock, as claimed in any preceding claim.

ABSTRACTA LOCK

5 A lock (1) comprises an electronic module (6) which in response to receiving an
authorisation signal from a contact less key (8) causes movement of handle (4) to release a
bolt (19) from aperture (3). The electronic module (6) is replaceable and is retained in
place by a catch (16) that may be released by actuation of a mechanical lock (11) normally
secured behind a security plate (9).

Figure 1

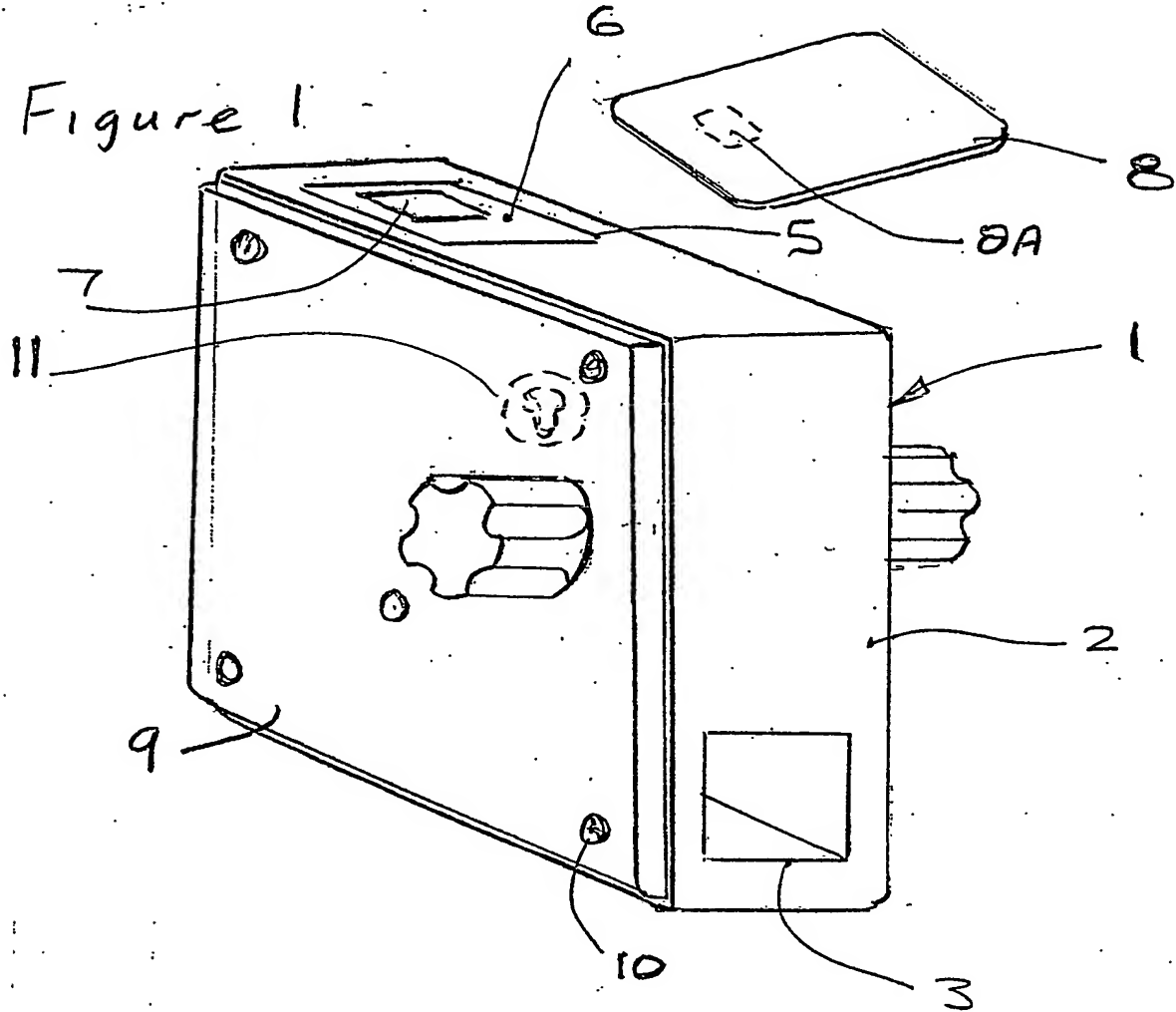


Figure 6

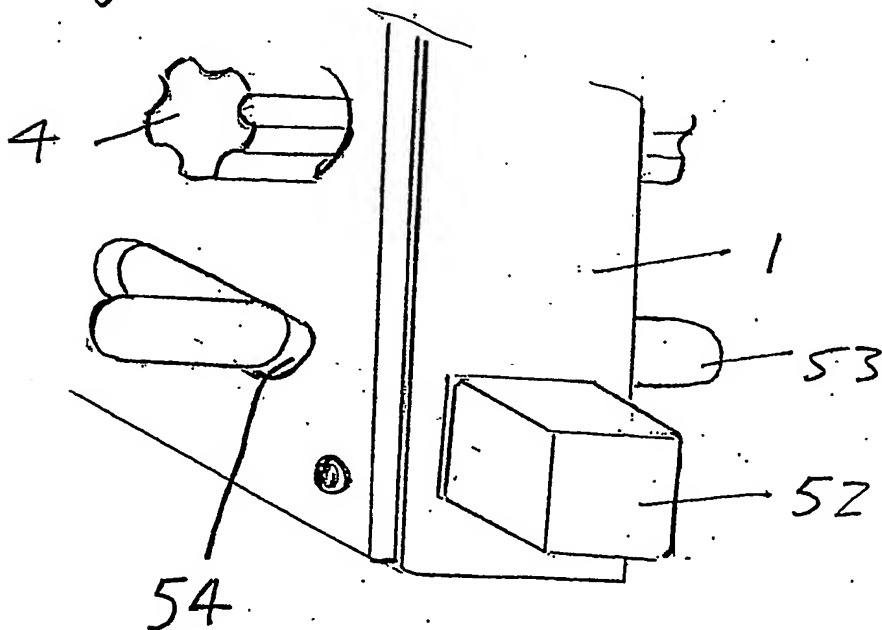
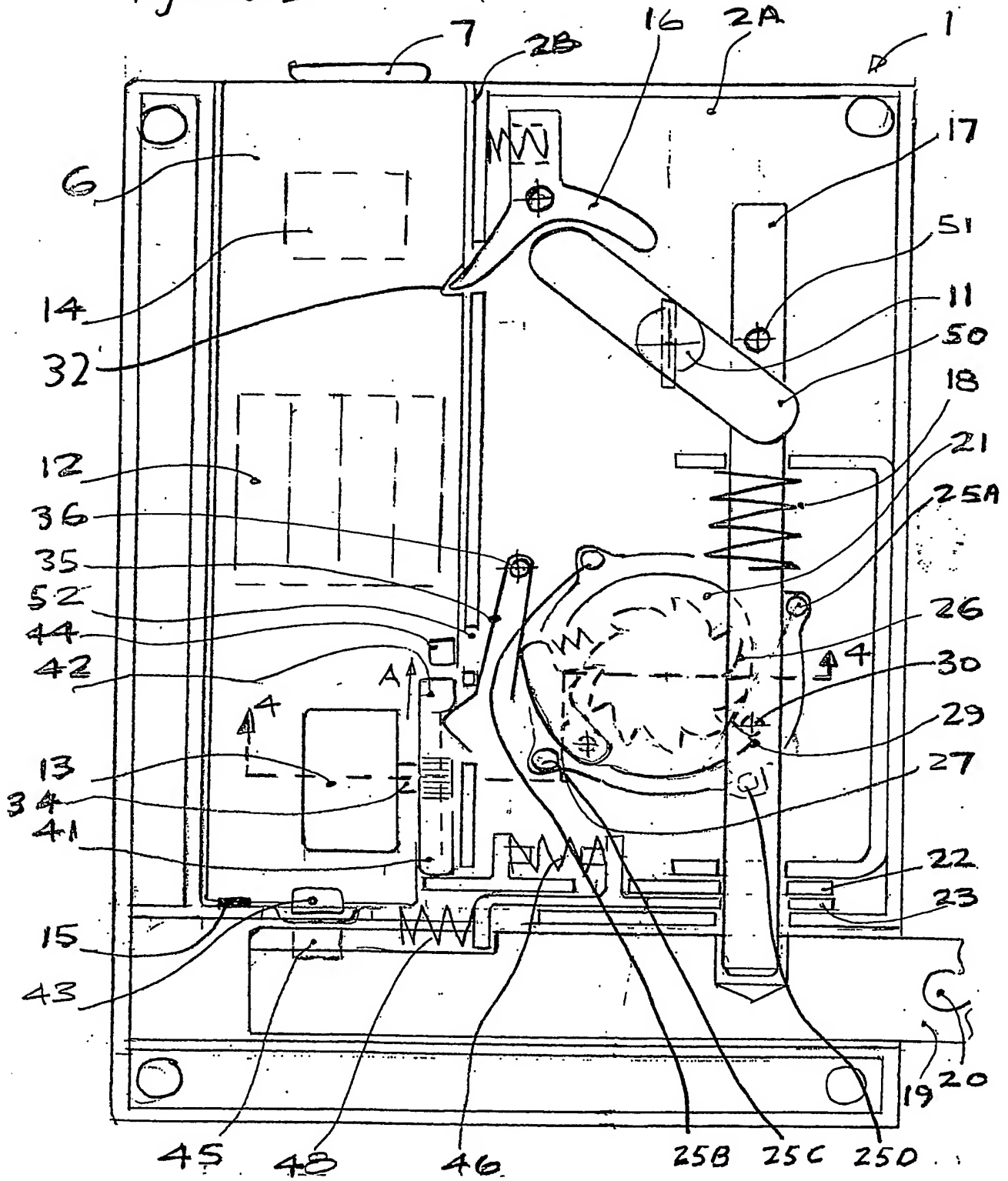
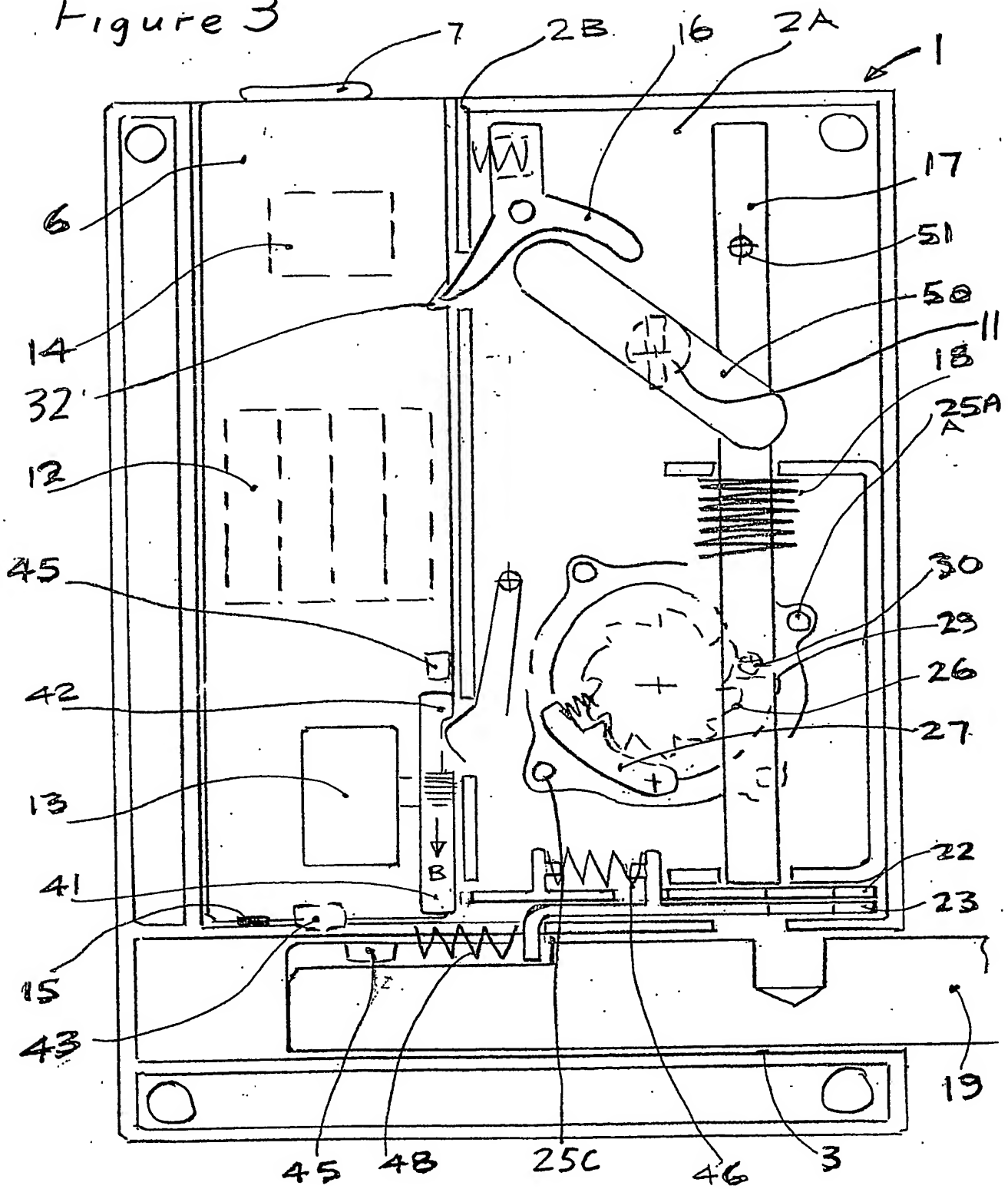


Figure 2



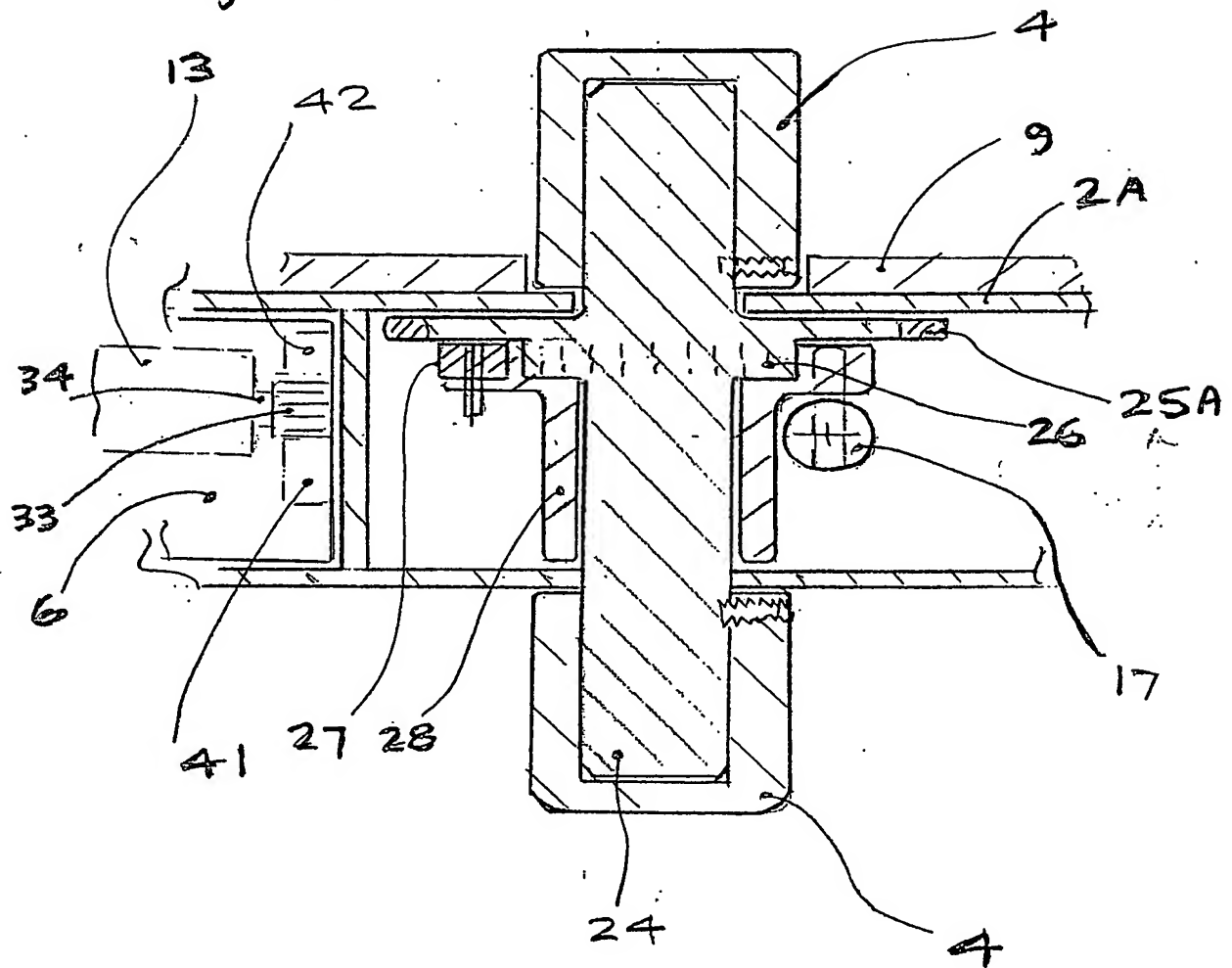
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Figure 3



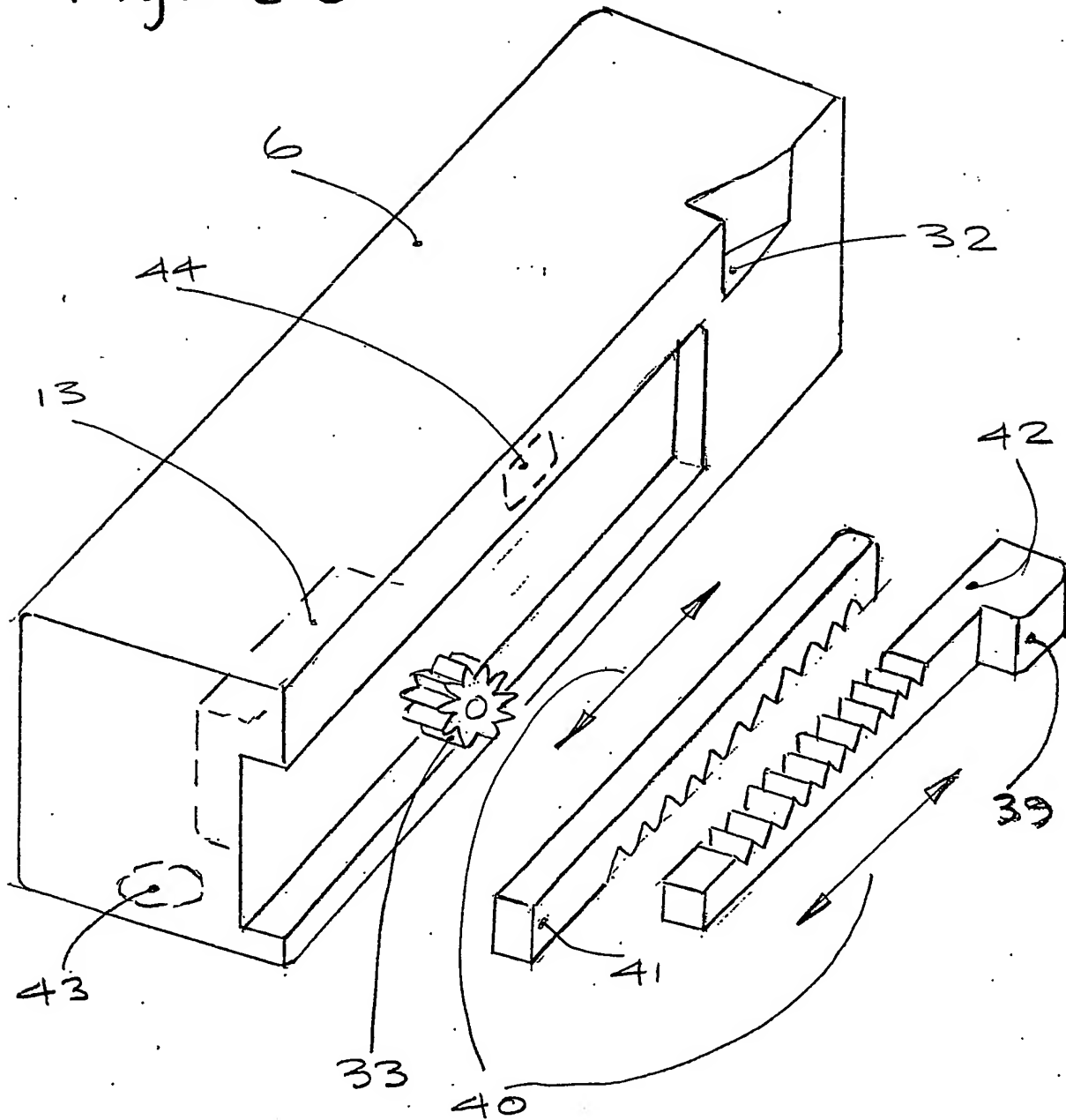
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Figure 4



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Figure 5



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